Transfer and Manipulation of Appearance from the Image of a Sphere

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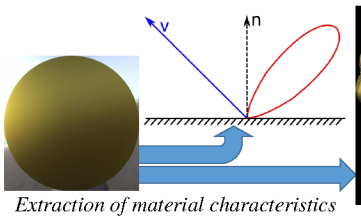
Goals

- **Vision**: Extract material characteristics from a single image of a sphere
- **Graphics**: Transfer its appearance to another shape and manipulate material & lighting



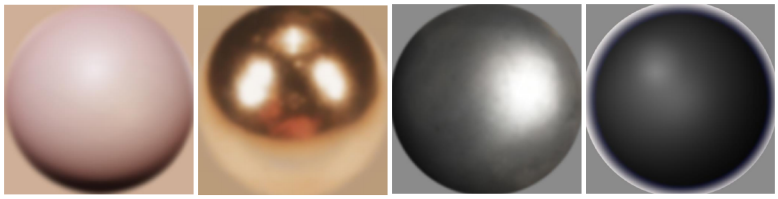
Extraction of material characteristics


Appearance transfer


Appearance manipulation

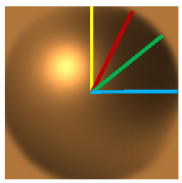
Input Image

- Image of a Sphere seen from an orthographic view
- Obtained by photography, rendering, painting, matcaps (ZBrush™)
- LitSphere [Sloan01]: use normal orientation for color look-up
  - × Does not permit manipulations of material or lighting...



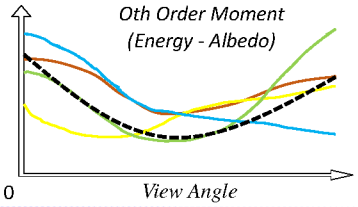
Inferring Material Properties

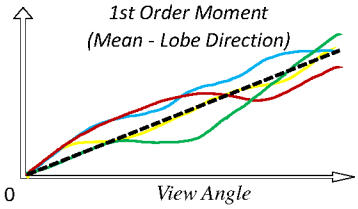
- Hypothesis: uniform BRDF defined by view-dependent Gaussian lobes
- The Gaussian lobe is completely defined by the 0^{th} to 2^{nd} order moments
- Lobe statistics (moments) observable through slices of input LitSphere
- Use redundancy across slices to recover view-dependent lobe parameters

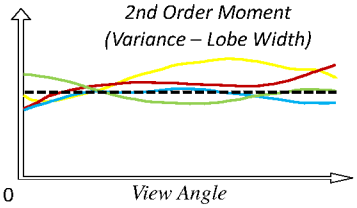


Statistics measured from slices show redundancy across viewing angles

Dashed lines represent the estimated BRDF lobe parameters

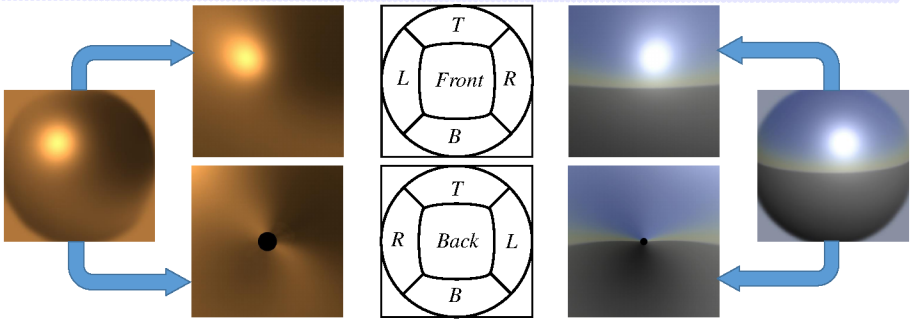






Output Representation

- **Pre**-filtered environment lighting: spherical map looked-up via lobe direction
- Material parameters: albedo and lobe width profiles characterize lobe shapes
- Directions reaching the back of our spherical map might not be filled in.
  - × They need to be reconstructed

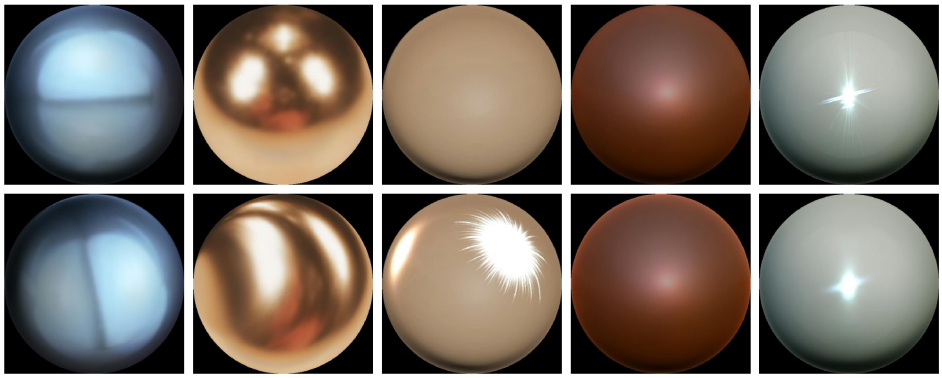


Paraboloid map visualization of our reconstructed spherical map

Manipulation

	Manipulation	Rotate Light	Warp Light	Add Light	Mat. Fresnel	Mat. Gloss
Re-filter	Albedo	X	X	X	X	X
	Direction	X	X			
	Width			X		X

- **Re**-filtering the spherical map using inferred material properties permit to manipulate appearance without knowledge of lighting
- The table presents different types of manipulations and the lobe moments they rely upon
- The resulting spherical map is readily used to shade arbitrary-shaped objects as with LitSpheres
- Spatially-varying effects may be produced simply by varying filtering parameters on the surface



Conclusions

- A single image of a sphere contains **sufficient information** for the manipulation of appearance
- BRDF **lobe moments** and their profiles could be considered as relevant characteristics to perception

prism

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